PARTICULATE MATTER MONITORING NETWORK DESCRIPTION FOR SOUTH COAST AIR BASIN AND COACHELLA VALLEY MONITORING PLANNING AREAS

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1.0 INTRODUCTION

This Document details the South Coast Air Quality Management District's (SCAQMD) plan to accomplish the implementation of the $PM_{2.5}$ monitoring network that has been promulgated by the United States EPA. The plan will include the network plans for both the South Coast Air Basin and the Coachella Valley Monitoring Planning Areas.

1.1 Physical Setting

The SCAQMD has jurisdiction over approximately 12,000 square miles consisting of the four-county South Coast Air Basin and Riverside County portions of the Salton Sea Air Basin, formerly the Southeast Desert Air Basin. Figure 1-1 shows the boundaries of the SCAQMD. The South Coast Air Basin is an approximately 6,600 square mile area bounded by the Pacific Ocean to the west and the San Gabriel, San Bernardino, and San Jacinto Mountains to the north and east. It includes all of Orange County and the non-desert portions of Los Angeles, Riverside, and San Bernardino counties.

The Salton Sea Air Basin portion of Riverside County is bounded by the San Jacinto Mountains in the west and spans eastward up to the Palo Verde Valley (Blythe). The federal nonattaiment area known as the Coachella Valley Planning Area is a subregion of the Salton Sea Air Basin and consists of an approximately 2,500 square mile portion of Central Riverside County. The Coachella Valley is aligned in a northwest-southeast orientation stretching from Banning Pass to the Salton Sea. It is approximately 120 miles east of downtown Los Angeles and is bounded by the San Jacinto Mountains to the west which rise to an elevation of over 10,000 feet, and the Little San Bernardino Mountains to the east which reach heights of over 5,000 feet. In the Coachella Valley, the elevation ranges from about 500 feet above sea level in the northern part of the valley to about 150 feet below sea level near the Salton Sea.

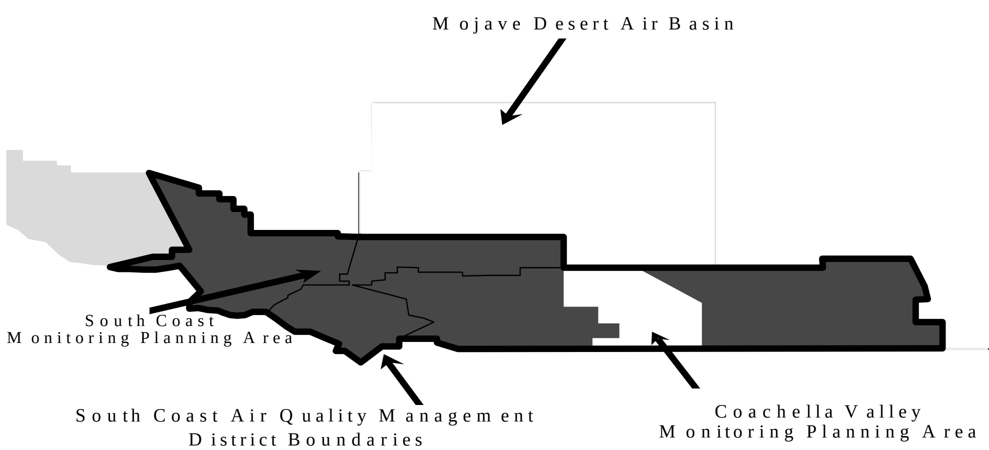


Figure 1.1.1 Boundaries of the South Coast Air Quality Management District.

1.2 Population Characteristics

The South Coast Air Basin (Basin) has experienced faster population growth than the rest of the nation since the end of World War II. Although growth has slowed somewhat, the region's population is expected to increase significantly towards the end of the century and through 2020. Table 1.1.1 shows the projected growth based on The Southern California Association of Government's regional growth forecast. As shown in the Table, the population in the South Coast Air Basin is expected to increase 1.5 times by the year 2020 from the 1990 levels.

The Coachella Valley is an even more rapidly growing area, with the population expected to double by the year 2020 from 1990 levels. As shown in Table 1.1.1, the valley's 1990 population was 267,000, with growth to 598,000 expected by the year 2020. In addition to its permanent residents, over 100,000 seasonal residents spend three to six months in the Coachella Valley. The northern part of the valley, northwest of Indio, is the most densely populated area, with residential housing primarily toward the wind-sheltered areas near the foothills of the Santa Rosa Mountains. In recent years, however, population growth has pushed the residential development northward, closer to the high wind belt.

Table 1.1.1 Historical population and population growth forecasts

Year	South Coast Air Basin	Coachella Valley
1950	4,800,000	N/A
1980	10,500,000	139,000
1990	13,022,000	267,000
2000	14,798,000	374,000
2010	16,653,000	469,000
2020	18,926,000	598,000

1.3 Climate and Weather

The topography and climate of Southern California combine to make the Basin an area of high air pollution potential, including $PM_{2.5}$ and PM_{10}. During the summer months, a warm air mass frequently descends over the cool, moist marine layer produced by the interaction between the ocean's surface and the lowest layer of the atmosphere. The warm upper layer forms a cap over the cool marine layer and inhibits the pollutants in the marine layer from dispersing upward. In addition, light winds during the summer further limit ventilation. These conditions are ideal for the formation of fine particles from precursor gaseous emissions. The abundance of afternoon sunlight and the persistence of morning fog and low clouds trigger both homogeneous (gas phase chemistry) and heterogeneous (aqueous phase chemistry) reactions forming secondary particles in the Basin. In addition, the dry, hot summers are conducive to the generation of fugitive dust from earth-disturbing activities.

In the fall and winter months, two meteorological conditions can occur which are conducive to high PM levels. Unlike the spring and summer months when persistent onshore winds sweep across the Basin to the north and east, high pressure periodically develops over the desert areas in the fall and winter. If the desert high pressure system is weak, the desert high pressure counteracts the onshore sea breeze leading to very stagnant conditions in the Basin. Some of the highest 24-hour PM levels resulting from secondary particles occur under this meteorological regime. If the desert high pressure system is strong, then Santa Ana winds occur. Gusting at times to velocities in excess of 60 miles an hour, Santa Ana winds flow from the north and east toward the ocean. This condition can lead to high levels of PM_{10} resulting from windblown fugitive dust.

The climate of the Coachella Valley is of the continental desert type, with hot summers, mild winters, and very little annual rainfall. Precipitation is less than six inches annually and occurs mostly in the winter months from active frontal systems, and in the late summer months from thunderstorms. Temperatures exceed 100 degrees Fahrenheit, on the average, for four months each year, with daily highs near 110 degrees Fahrenheit during July and August. Summer nights are very mild with minimum temperatures in the mid-70's. During the winter season, daytime highs are quite mild, but the dry air is conducive to nocturnal radiational cooling, with early morning lows around 40 degrees.

The Coachella Valley is exposed to frequent gusty winds, primarily during the spring and early summer months. The strong and most persistent winds typically occur immediately to the east of Banning Pass. This wind condition is caused by strong pressure and air mass density differences between the desert air mass and the marine-modified coastal air mass. Surface low pressure in the desert causes cooler and denser ocean-modified air to move through Banning Pass into the Coachella Valley. As synoptic weather patterns reinforce the localized regime through wind-inducing surface pressure gradients, strong and widespread winds result. These winds can persist for many hours and generally have a west-through-north wind component. Winds can also be generated by strong downbursts from summertime thunderstorms. Winds generated by this condition are more localized in nature, but strong downrushes of cooler air can produce wind gusts which occasionally exceed 60 mph. These wind gusts and gust fronts can pick up large amounts of natural desert soils which, once suspended in the atmosphere, can be transported over large distances, even though the gustiness subsides. Since the necessary weather pattern for producing such thunderstorms is one in which high level tropical moisture is transported into the deserts from areas to the southeast, these storms are typically associated with erratic southeasterly winds.

1.4 Dominant Economic Activities and Emission Sources

The economic base of the Basin is diverse. Historically, the four counties of the Basin have collectively comprised one of the fastest-growing local economies in the United States. Until recently, the aerospace and electronic industries accounted for about 20 percent of the Basin's employment. Significant changes have occurred in the composition of the industrial base of the region in the past ten years. As in many areas of the country, a large segment of heavy manufacturing, including steel and tire manufacturing and automobile assembly, has been phased down. The aerospace and electronics industries have been reduced in scale by cutbacks in defense spending. Replacing much of the heavy industry has been new growth in small service industries and businesses related to increased shipping and trade.

Particulate matter in the Basin can either be directly or indirectly emitted from a variety of emissions sources. These sources can be natural, such as oil seeps, vegetation, or windblown dust. Emissions may also result from combustion, as in automobile engines; from evaporation of organic liquids, such as those used in coating and cleaning processes; or through abrasion, such as from tires on roadways. In 1995, 412 tons per day of PM_{10} were emitted in the Basin. Over 80 percent of these emissions were caused by stationary sources, with approximately 333 tons contributed by fugitive dust from geological sources. About 38 tons per day of primary PM_{10} emissions were emitted by mobile sources. Point sources contributed the remaining 10 percent of the PM_{10} emissions in the Basin.

The economy of the Coachella Valley is presently dominated by recreation, tourism and agriculture. Tourist amenities include 85 golf courses, 270 motels with a total of 15,800 rooms, and large conference facilities. The area has over 58,000 acres of productive farmland with grapes, citrus, dates, and vegetables being the major crops. Total crop production in 1992 exceeded 283 million dollars. Agricultural activity is dominant south of Indio. Large employers in the area include Bird Products (manufacturing), Armtec Products (defense), and Sun World (food processing).

In 1995, 48 tons per day of PM_{10} were emitted in the Coachella Valley. Over 96 percent of these emissions were caused by stationary sources, with approximately 47 tons contributed by windblown dust, entrained road dust, construction/demolition operations, and farming operations. About 1.4 tons per day of primary PM_{10} emissions were emitted by mobile sources.

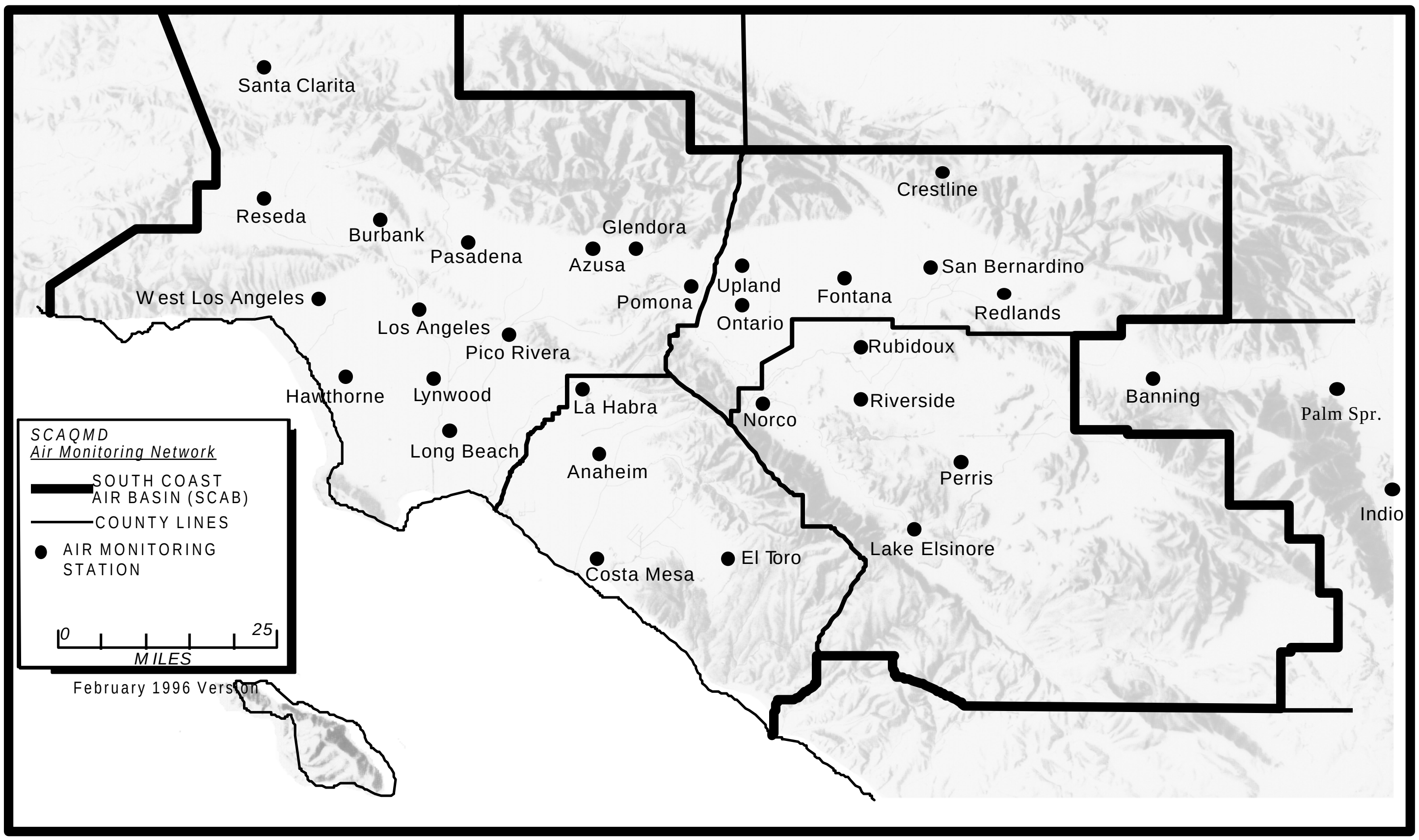
1.5 $PM_{2.5}$ Monitoring Requirements

Three major metropolitan statistical areas (MSA) lie within the Basin--Los Angeles-Long Beach area, the Anaheim-Santa Ana area, and the Riverside-San Bernardino area. A map showing existing NAMS-SLAMS sites for monitoring gaseous and particulate pollutants is shown in Figure 1.5 and each MSA, it's population and number of required monitors is shown in Table 1.5.1. Each area has a population in excess of one million, thus requiring a minimum of two core sites. An additional site is required since the air basin is a PAMS monitoring area. Proposed $PM_{2.5}$ sites are listed and discussed in the following sections.

Table 1.5.1 $PM_{2.5}$ Monitoring Requirements

MSA/PMSA	Population in 1990	Core Monitors Based on Population		Core Monitors in PAMS areas (sampling everyday)	Total Core
		sampling everyday	Sampling 1 in 3 day		
Los Angeles-Long Beach, CA PMSA	8,863,164	2	8	0-1	10-11
Riverside-San Bernardino, CA PMSA	2,588,793	2	2	0-1	4-5
Orange County, CA PMSA	2,410,556	2	2	0	4
Coachella Valley CA PMSA	267,000	0	1	0	1

Figure 1.5.1 Existing NAMS/SLAMS Sites for Gaseous And Particulate Pollutants



South Coast Air Basin and Coachella Valley Monitoring Planning Areas

2.0 $PM_{2.5}$ MONITORING NETWORK ELEMENTS

Several types of $PM_{2.5}$ monitors are proposed for use in the monitoring network. This section summarizes the following: monitors planned for deployment in 1998 and 1999, and existing particulate monitors at proposed $PM_{2.5}$ sites. In addition to the South Coast Air Basin, the SCAQMD has jurisdiction over that northwest portion of the Salton Sea Air Basin in Riverside County. Monitoring in that area is included in the South Coast monitoring network description. For a summary of particulate matter outside the South Coast monitoring network, please refer to the statewide summary.

2.1 $PM_{2.5}$ Monitors Planned for Deployment

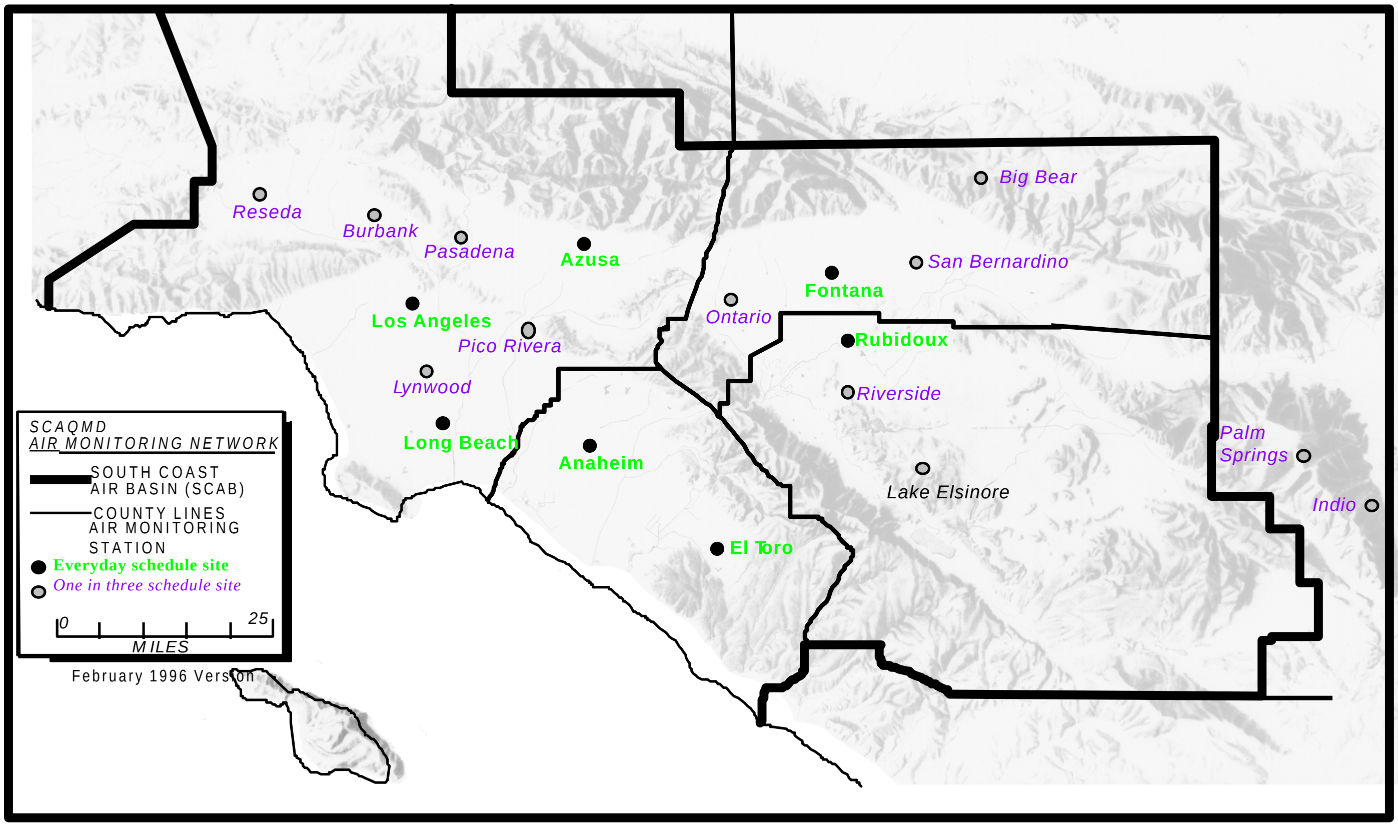
In order to satisfy monitoring program objectives of the $PM_{2.5}$ program, several types of monitors will be employed. The primary objective of the monitoring program is the development of a larger $PM_{2.5}$ data base than currently exists to asses compliance with the national ambient air quality standards (NAAQS) over a larger geographical area than covered by the existing data base. Such measurements would be made with federal reference method (FRM) monitors. In addition, chemical speciation determinations are planned to resume at selected sites using the SCAQMD's PM_{10} Technical Enhancement Program (PTEP) samplers described in section 4.2. This type sampler was used during the extensive $PM_{2.5}$ monitoring program conducted in 1995. Also planned for use in the network are continued use of several dichotomous samplers and real-time continuous monitors based on the beta attenuation principle (BAM). See the map, Figure 2.1.1 and Table 2.1.1 below for the planned distribution of monitors, by type.

Table 2.1.1 $PM_{2.5}$ Monitoring Network

Site Location	AIRS Site ID	$PM_{2.5}$ FRM	$PM_{2.5}$ Speciation	$PM_{2.5}$ TEOM/BAM	Other $PM_{2.5}$
Anaheim	060590001	XX	X		
Azusa	060370002	X			PAMS
Banning	060650012			BAM	
Big Bear	New Site	X			
Burbank	060371002	X			
Fontana	060712002	XX	X		
Indio	060652002	XY		BAM	Dichot
Lake Elsinore	060659001	Y			
Lake Forest	060592001	X			
Long Beach	060374002	X			
Los Angeles	060371103	XX	X		
Lynwood	060371301	X			
Ontario	060716001	X			
Palm Springs	060656001	Y			
Pasadena	060372005	X			
Pico Rivera	060371601	X			
Reseda	060371201	X			
Riverside	060658001	X			
Rubidoux	060658001	XX	X		
San Bernardino	060719004	X			Dichot
Santa Clarita	060376002			BAM	

Codes:
X - Monitor to be deployed in 1998
Y - Monitor to be deployed in 1999
XX- Collocated particulate monitors used for precision data to be deployed in 1998
YY- Collocated particulate monitors used for precision data to be deployed in 1999

Figure 2.1.1 Planned Locations of Monitors



South Coast Air Basin and Coachella Valley Monitoring Planning Areas

2.2 Existing Particulate Matter Monitors

The SCAQMD's current particulate network, in addition to the several monitors for $PM_{2.5}$, consists of SSI High Volume, dichotomous samplers, TSP High Volume, and beta attenuation monitors (BAM) and tapered element oscillating microbalances (TEOM). These monitors and respective current locations are shown in Table 2.2.1 below. For a statewide summary of particulate matter monitoring outside the presently described network, please refer to the statewide summary.

Table 2.2.1 Existing Particulate Matter Monitors

Site Location	AIRS Site ID	Dichot	PM10 SSI	PM10 TEOM/BAM	Existing Particulate Matter Monitors
Anaheim	060590001		X	BAM	
Azusa	060370002		X	BAM	
Banning	060650012		X		
Burbank	060371002		X	TEOM	
Crestline	060710005		X		
Fontana	060712002		X		
Glendora	060370016			TEOM	
Hawthorne	060375001		X		TSP
Indio	060652002	X	X	BAM	
Lake Elsinore	060659001			TEOM	
Lake Forest	060592001	X			
Long Beach	060374002	X	XX	TEOM	TSP
Los Angeles	060371103		XX	BAM	TSP
Lynwood	060371301				TSP
Norco	060650003		X		
Ontario	060716001		XX		
Palm Springs	060656001		X	BAM	
Perris	060656001		X		
Pico Rivera	060371601				TSP
Redlands	060714003		X		
Riverside	060651003				TSP
Rubidoux	060658001		XX	TEOM, BAM	TSP
San Bernardino	060719004	X			TSP
Santa Clarita	060376002		X		
Upland	060711004			TEOM	TSP

Codes:

X Existing monitor
XX Collocated particulate matter monitor used for precision data
TSP Total Suspended Particulate high volume sampler
BAM Beta Attenuation PM_{10}
TEOM Tapered Element Oscillating Microbalance PM_{10}

2.3 $PM_{2.5}$ Quality Assurance

The SCAQMD is committed to achieving the very high level of data quality mandated for the $PM_{2.5}$ monitoring program. The enabling legislation dictates that a wide array of Quality Assurance (QA) and Quality Control (QC) activities be performed by the Federal, State, and local agencies. These activities will assure that data generated in the program meets the program's data quality objectives for accuracy, precision, representativeness and completeness.

Quality Control activities are those procedures employed by the staff responsible for operation of the sample collection and analysis. Under the guidance outlined in the Draft EPA Quality Assurance Handbook, Volume II, Part II, Section 12, SCAQMD will establish procedures for day-to-day operations by SCAQMD staff. QC procedures include but are not limited to: annual multipoint sampler flow calibrations; biweekly sampler flow rate and leak checks; pre-sampling and post sampling temperature and pressure sensor checks; monthly timer accuracy checks; semimonthly inlet, impactor and well cleaning; quarterly inspection and greasing of sampler o-rings; lab and field blanks on three filters of each filter lot; annual microbalance certification; daily microbalance zero and standard checks; and daily balance room environmental checks. These QC activities will be performed by SCAQMD staff and will be implemented concurrently with the network implementation schedule.

Quality Assurance activities are procedures conducted in addition to the day-to-day operations of sampling and analysis that assure that the program's data quality objective are being met. The Draft EPA Quality Assurance handbook cited above also establishes criteria for $PM_{2.5}$ QA operations. The $PM_{2.5}$ QA activities will be performed by staff from EPA, CARB and SCAQMD. These activities will serve to assess the $PM_{2.5}$ program's accuracy, precision, representativeness and completeness. The QA activities include but are not limited to: FRM audits performed by an EPA contractor (that are actually independent parallel sampling and analysis); quarterly flow, temperature and pressure audits conducted by SCAQMD auditors; collocated sampling at 25% of the sampling sites; and annual system and flow audits performed by ARB staff. The QA activities performed by SCAQMD will commence in the first quarter of operation of the monitoring network. SCAQMD will also participate in any laboratory system or performance audits conducted by EPA or ARB.

The SCAQMD is also prepared to institute other QA or QC activities that it determines appropriate. These activities might include QC procedures for sample media preservation during transport and storage as well as QA procedures for data validation and reporting. SCAQMD expects to work in close cooperation with EPA and ARB to implement all necessary QA/QC procedures necessary to assure valid $PM_{2.5}$ data.

2.4 Laboratory Analyses

The SCAQMD's Laboratory will conduct all weighing of filters for mass determination. The District measured in excess of 1500 filters for its PTEP program run in 1995. The District presently uses temperature and humidity controlled chambers but will install a temperature and humidity controlled room for the microbalance within 3 months of receiving federal 103 grant funds. SCAQMD Laboratory Technicians have ten years experience in the handling of Teflon 47 mm filters.

The SCAQMD uses a Cahn (ATI) 38-C microbalance reading to 0.001 milligram. The microbalance is interfaced to a computer utilizing a database program designed by SCAQMD to store data and make reports for Quality Assurance. The microbalance is on a marble table and operated in accordance with the SCAQMD Quality Assurance/Quality Control program. The SCAQMD will install a second identical system by the second quarter of 1999 to handle the expected workload.

Filters will be received from the field in coolers within three working days of sampling and immediately placed in the temperature/humidity controlled environment for a minimum of 24 hours. The mass determination will follow the SCAQMD Standard Operating Procedure (SOP) that is in compliance with federal and state regulations. Once the filters are weighed they will be stored in refrigerators for a minimum of one year. The quality assured flow determinations from the field technicians will be transferred to the microbalance computer and the final report transferred to AIRS.

3.0 $PM_{2.5}$ MONITORING SITES TO BE DEPLOYED IN 1998

The SCAQMD is planning to deploy seventeen $PM_{2.5}$ sites in 1998. Out of these, seven are considered SLAMS core sites. The balance of the sites are non-core one in three day sampling sites. This section defines why those sites were selected along with more important parameters that characterize those sites.

3.1 Monitor Siting

The U.S. EPA Federal regulation for $PM_{2.5}$ requires that criteria for site selection include locations with expected maximum concentrations and population density (Figures 3.1.1 and 3.1.2 show population and PM_{10} concentrations respectively, for the South Coast Air Basin). SCAQMD has historically conducted monitoring in those areas where high population exists as its primary mission. The most highly concentrated population exists in Los Angeles county. Therefore the largest number of sites will be located in that county. The inland counties, Riverside and San Bernardino, are less densely populated but are receptors for emissions from upwind areas during the prevailing onshore air mass flow. These inland areas experience the highest concentrations of particulate found in the South Coast Air basin.

Figure 3.1.1 Population Concentration in South Coast Air Basin

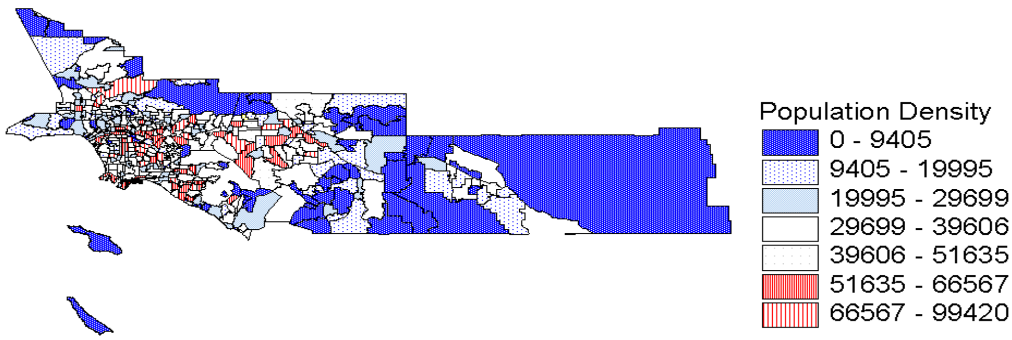
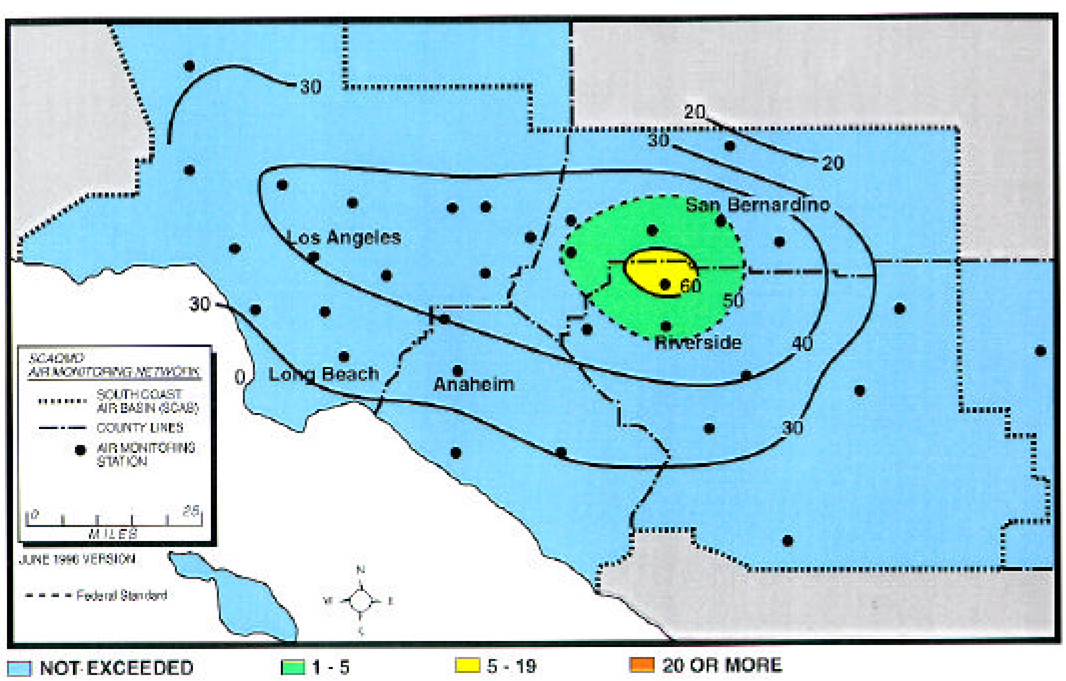


Figure 3.1.2 PM_{10} Concentrations in the South Coast Air Basin



Orange County is less densely populated than Los Angeles County; however particulate levels are consistently lower in Orange County than the inland counties.

The northwest portion of the Salton Sea Air Basin, the Coachella Valley, experiences some transport from the South Coast Air Basin, but also has its own sources of particulate, primarily crustal matter. SCAQMD has, over the years, attempted to locate its monitoring sites in locations that are representative of the populated areas. Thus it is appropriate to locate $PM_{2.5}$ sites at existing monitoring locations whenever practical. It is also desirable to locate $PM_{2.5}$ sites at locations that have previously measured PM_{10} and TSP to better understand the size distribution of particulate matter. There are also several main transport routes from the South Coast Air Basin that should be documented -- the Soledad and Cajon Passes into the Mojave Desert Air Basin and the San Gorgonio Pass into the Salton Sea Air Basin. This transport can be studied with a combination of FRM and continuous analyzers. Further, SCAQMD will include a mountain area monitor where winter populations increase due to recreational activities. The proposed site is Big Bear, in the Central San Bernardino Mountains, which lies in a valley where wood smoke may be a factor during the winter season. The proximity of an existing air monitoring site in Crestline is not topographically favored for potential woodsmoke accumulations, nor does that area experience the recreational increase in population that Big Bear receives.

3.2 Site Description

In 1998 the SCAQMD will deploy 17 $PM_{2.5}$ sites using Federal Reference Method (FRM) samplers. These samplers will be purchased through national contracts. Data from these sites will be compared with both the annual average standard and the 24-hour average standard to extend the current $PM_{2.5}$ data base. These sites are population-oriented in keeping with the SCAQMD's historic mission, and they are representative of a neighborhood spatial scale. These sites are all neighborhood scale and set out a good ground work for the network, giving wide geographic coverage and lying in the two primary air mass routes from the Los Angeles County and Orange County coastal areas to the inland valleys. (See Table 3.2.1.) Anaheim and Lake Forest are in residential-commercial areas, Los Angeles and Long Beach are in commercial areas with some vehicular traffic influence, Azusa is in a light industrial area, and Fontana and Riverside (Rubidoux) are in semi-rural residential areas. A site description containing greater detail of each site will be included with the final $PM_{2.5}$ network plan. An example of a site report is included as attachment A.

Table 3.2.1 $PM_{2.5}$ Sites to be Deployed in 1998

Site Location	Airs Site ID	Operating Agency	Spatial Scale	Monit. Objective[2]	Site Type[3]	Meas. Method[4]
Anaheim	060590001	SC	N[1]	R	C	FRM
Azusa	060370002	SC	N	R, P	C	FRM
Big Bear	New Site	SC	N	R	S	FRM
Burbank	060371002	SC	N	R	S	FRM
Fontana	060712002	SC	N	M,T	C	FRM
Lake Forest	060592001	SC	N	R	C	FRM
Lynwood	060371301	SC	N	R	S	FRM
Long Beach	060374002	SC	N	R, HS	C	FRM
Los Angeles	060371103	SC	N	R,M	C	FRM
Ontario	060716001	SC	N	M	S	FRM
Pasadena	060372005	SC	N	R	S	FRM
Pico Rivera	060371601	SC	N	R	S	FRM
Reseda	060371201	SC	N	R	S	FRM
Riverside	060651003	SC	N	R, T	S	FRM
Rubidoux	060658001	SC	N	M	C	FRM
San Bernardino	060719004	SC	N	R,T	S	FRM
Indio	060652002	SC	N	M,T	S	FRM

1 Neighborhood Scale

2 Monitoring Objective Codes: R - To determine high concentrations in a populated area; M - To determine the highest concentration expected to occur in an area covered by the network; T - to determine the extent of regional pollutant transport; HS - to support special health studies; P - Location satisfying PAMS requirement.

3 Site Types: C - Core SLAMS; S - Non Core SLAMS; P - Special Purpose Monitors.

4 The proposed FRM device is the Graseby sequential sampler.

4.0 $PM_{2.5}$ MONITORING SITES TO BE DEPLOYED IN 1999

In 1999 the SCAQMD plans to establish additional $PM_{2.5}$ FRM monitors to complement the sites established in 1998. These sites will provide additional information in better defining boundaries of non-attainment areas and clarify transport routes and satisfy other objectives of the $PM_{2.5}$ monitoring network. The SCAQMD also plans to deploy real-time continuous $PM_{2.5}$ monitors in 1999 to supplement the FRM network. See also Section 3.0

4.1 Monitoring Sites Operating $PM_{2.5}$ FRM Monitors

In 1999 SCAQMD is planning to deploy additional monitoring sites equipped with FRM monitors. Lake Elsinore has been selected as a site for better geographical representation of attainments/nonattaiment boundaries and to support ongoing heath studies and Palm Springs has been selected to provide better representation for local conditions and regional transport. Lake Elsinore is in a commercial/residential area with some impact from vehicular traffic and Palm Springs is a residential area.

Table 4.1.1 $PM_{2.5}$ Monitoring Sites to be Deployed in 1999

Site Location	Airs Site ID	Operating Agency	Spatial Scale	Monit. Objective	Site Type	Meas. Method
Lake Elsinore	060659001	SC	N	M,HS	S	FRM
Palm Springs	060655001	SC	N	M,T	S	FRM

(Legend: See Table 3.2.1)

4.2 $PM_{2.5}$ Chemical Speciation Sampling

SCAQMD proposes to conduct sampling for chemical speciation at 4 sites using PTEP samplers as was the case in the extensive study in 1995. The sampling location will be the same as in that study and shown in Table 4.2.1 below. The SCAQMD is strongly recommending the use of the PTEP samplers to allow for better continuity of speciated data. These samplers have demonstrated excellent field results, and have compared well to the FRM in limited sampling.

Table 4.2.1 $PM_{2.5}$ Chemical Speciation Monitoring

Site Location	Airs Site ID	Operating Agency	Monitoring Method
Anaheim	060590001	SC	TEP-2000
Fontana	060712002	SC	TEP-2000
Los Angeles	060371103	SC	TEP-2000
Rubidoux	060658001	SC	TEP-2000

PTEP Enhanced Ambient Air Monitoring Program

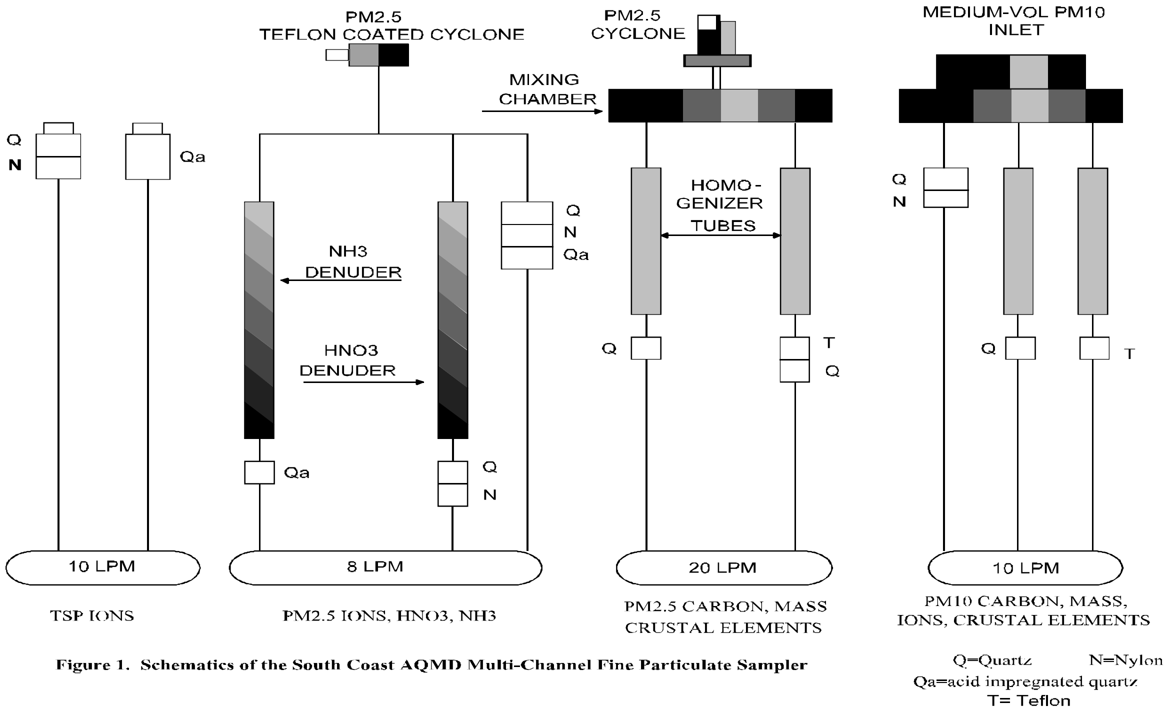
In December 1994, the SCAQMD initiated a comprehensive program, the PM_{10} Technical Enhancement Program (PTEP), to characterize fine particulate matter in the South Coast Air Basin (Basin). To build an optimal PM database for the 1997 PM_{10} State Implementation Plan (SIP) and Air Quality Management Plan (AQMP) revision, a one-year special particulate monitoring program was initiated in January 1995 as part of the PTEP program. Under this enhanced monitoring, nitric acid, ammonia, and speciated PM_{10} and $PM_{2.5}$ concentrations were measured at five stations in the Basin and at one background station at San Nicholas Island, located 80 miles off the Southern California Coast. The PM_{10} data was the first speciated data collected for air quality planning purposes since 1986, and the $PM_{2.5}$ data was the first such speciated data collected in the Basin on an annual basis. The successful one-year PTEP monitoring program was essential to the modeling analysis and development of the 1997 AQMP.

TEP 2000 Enhanced Ambient Air Monitoring Program

As a sequel to the PTEP program, the SCAQMD has initiated, a comprehensive program to characterize the ozone and PM problem in the Basin for the upcoming 2000 AQMP. Under this Technical Enhancement Program for the 2000 AQMP revision (TEP 2000), a one-year special monitoring program will be conducted in the Basin from August 1998 through July 1999. A one-in-three day sampling schedule will be conducted at eight sites including: Downtown Los Angeles, Anaheim, Diamond Bar, Fontana, Rubidoux, Ontario, Long Beach and Costa Mesa. In addition, if sufficient resources are available, daily sampling will be conducted at three of the sites (Downtown Los Angeles, Anaheim, and Rubidoux) during the peak October through November period. The TEP 2000 ambient monitoring program will provide a much more complete data base for the chemical speciation required under EPA's new $PM_{10}/PM_{2.5}$ regulatory standards, and more complete data for receptor and dispersion modeling. In the following text, PM sampler, sampling location and schedule, and sample analysis for the TEP 2000 program are explained.

SCAQMD-MCFP Sampler (PTEP Sampler)

For the PTEP special monitoring program, the PM sampler used for the SCAQS (Southern California Air Quality Study) was specially modified to improve sample handling and maintenance. The same modified PM sampler used for the PTEP program will be used for the TEP 2000 ambient monitoring program. The sampler consists of three separate components: the main sampler box, the control box, and the pump box. For ease of use, color-coded "quick fit" connections were used at all possible connection sites. The main sampler box, shown in Figure 4.2.1, has four channels and ten lines for measurement of PM_{10} and $PM_{2.5}$ mass, including both chemical and gaseous components.



Q = Quartz N = Nylon T = Teflon Qa = Acid Impregnated Quartz

Figure 4.2.1. Schematic of the SCAQMD Multi-Channel Fine Particulate Sampler.

Channel I (Lines 1 & 2): This channel is used to sample ambient total suspended particulate (TSP) aerosols. Two lines are located under a rain cover. Line 1 samples ambient air at a flow rate of 10 lpm through a quartz-nylon filter pack. This line is used to determine the maximum gaseous nitric acid concentration and maximum particulate nitrate and ammonium concentrations. Line 2 samples ambient air at the same flow rate as line 1 through an acid impregnated quartz filter. This line is used to determine the maximum possible gaseous ammonia and particulate ammonium concentrations. Data from both lines are used in the validation process as a check for nitrate and ammonium concentrations.

Channel II (Lines 3,4 & 5): This channel is used to sample $PM_{2.5}$. A Teflon coated, Walter John Cyclone is used to make a nominal 2.5 µm cut. Three sampling lines are located below this channel. Ammonia and nitric acid losses were minimized by the use of a short Teflon line into the cyclone and internal coating of the cyclone with Teflon. Channel II contains two stainless steel denuders used for ammonia and nitric acid. Line 3 feeds into the ammonia denuder columnar box consisting of strips of citric acid impregnated quartz filters which have been found to be efficient ammonia gas scavengers. Line 4 feeds into the nitric acid denuder, which consists of a stainless steel columnar box with anodized aluminum plates. A dual filter pack of quartz followed by nylon, is mounted below this denuder. The quartz filter collects the particulate nitrate and the nylon filter is used to quantitatively trap any gaseous nitric acid that has penetrated through the denuder and volatilized from the front quartz filter.

Line 5 consists of an all-Teflon filter pack (Savillex) with three stages. A quartz filter followed by a Nylosorb (Gelman) and citric acid impregnated quartz filter are all mounted beneath this line. This line collects $PM_{2.5}$ particulate, nitric acid and ammonia gas, and is used as the non-denuded leg of the denuder system to be used later for the determination of particulate nitrate, ammonium, nitric acid and ammonia gas by the denuder difference method.

Channel III (Lines 6 & 7): The two lines connected to this channel are used to sample fine particles for determination of $PM_{2.5}$ mass, organic and elemental carbon, and inorganic trace metals. The size segregation is made in this channel with the use of a stainless steel Sensydyne model 240 cyclone which has the desired inlet cut size. A stainless steel bowl with stainless steel mesh protects the inlet of the cyclone. Because of the high volume flow characteristic (110 lpm) of the cyclone, a stilling or mixing chamber coated with Teflon is used prior to the splitting of the flow into two lines. Since both the carbon analysis and elemental analysis utilize techniques whose precision is sensitive to the homogeniety of particle deposits on the filter, flow homogenizers were used. The homogenizers are 30 cm long stainless tubes with internal diameters of 4.5 cm. Line 6 samples $PM_{2.5}$ carbon while line 7 captures mass and inorganic trace metal concentrations.

Channel IV (Lines 8,9, & 10): The fourth channel is used to sample PM_{10}. A medium volume PM_{10} sampler (Anderson model GMW-254-I) is used as a PM_{10} inlet. Three lines are located below this channel. Line 8 is used to sample PM_{10} particulate ions using a quartz/nylon filter combination mounted on a Gelman filter holder. Line 9 is used to sample PM_{10} carbon with a flow homogenizer and a quartz filter mounted on a Gelman filter holder. Line 10 is used to sample PM_{10} mass and trace elemental components using a Palliflex Teflon filter mounted below a flow homogenizer.

Sampling Locations and Schedule

PM_{10} and $PM_{2.5}$ 24-hour sampling will be conducted at eight monitoring stations (Downtown Los Angeles, Anaheim, Diamond Bar, Fontana, Rubidoux, Ontario, Long Beach, and Costa Mesa) in the Basin as shown in Figure 4.2.2. Three more sampling locations (Ontario, Long Beach, and Costa Mesa) will be added to the PTEP sampling locations. The sampling will be performed both upwind and downwind of significant ammonia sources in the Basin. Diamond Bar is a representative area at the urban fringe and upwind of ammonia sources. Ontario represents a site downwind of primary urban particulate source and also located at significant ammonia sources. Fontana and Rubidoux represent downwind receptor areas and also downwind of ammonia sources. Monitoring will also be focused at sources with significant contributions by mobile and stationary source emissions. The Los Angeles and Anaheim sites are representative of primary vehicle and stationary source emissions areas. The Long Beach site is representative of coastal primary vehicle and stationary source emissions. Costa Mesa will be used as a coastal background site in the Basin to characterize PM data from the upwind clean background air mass moving into the Basin.

Enhanced Fine Particulate Monitoring Network

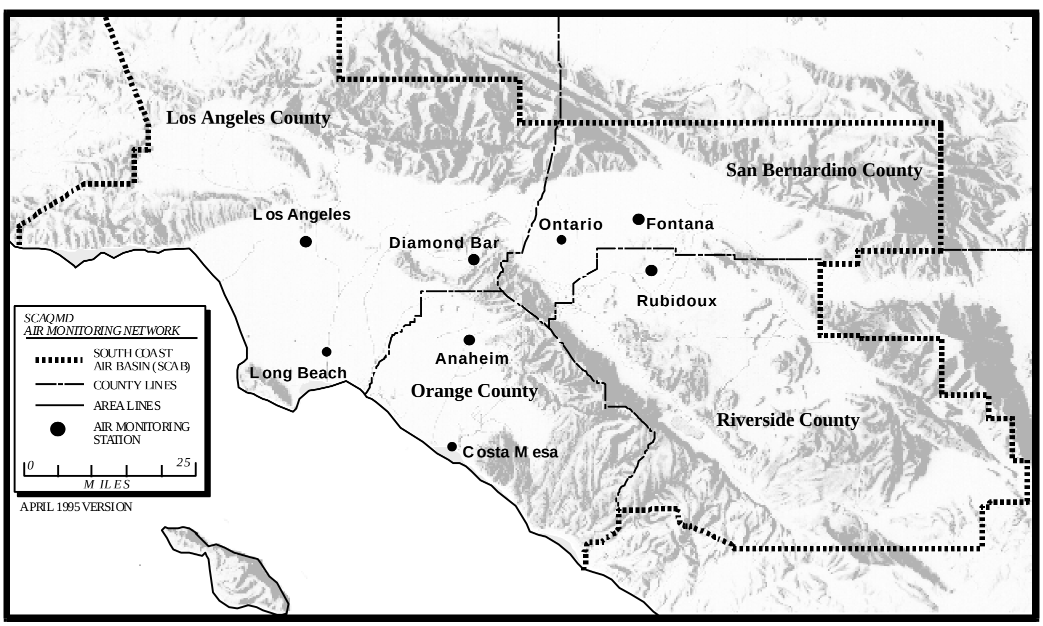


Figure 4.2.2 Particulate Monitoring Network for TEP 2000

The TEP 2000 monitoring program will be conducted from August 1998 through July 1999 on a one-in-three day sampling schedule. During the high PM season months of October and November, if sufficient resources are available, daily sampling will be conducted at three of the sites (Downtown Los Angeles, Anaheim, and Rubidoux) to provide a continuum of daily speciated database across the Basin to help validate the episodic PM model such as UAM-AERO and to provide a more detailed database for characterizing high PM conditions. To conserve limited resources, however, sampling will not be conducted on days of predicted rain.

Quality Assurance

At two of the eight locations (yet to be determined), duplicate PTEP samplers will be operated. This is consistent with EPA guidance of having 25 percent of the network be located with the same type of sampler.

Sample Analysis

At each location, state-of-the-science sampling equipment will be deployed to collect fine and coarse particulate fractions. Total mass and 43 species (Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Br, Rb, Sr, Y, Mo, Pd, Ag, Cd, In, Sn, Sb, Ba, La, Au, Pb, U, OC, EC, Cl, Na, NO_3, SO_4, NH_4) will be analyzed for a full chemical speciation of the particle data. Total mass will be determined gravimetrically as collected on Teflon filters, and the concentrations of 36 trace elements will be determined by Energy Dispersive X-ray Fluorescence. Quartz fiber filters will be used to collect samples to be analyzed for organic carbon and elemental carbon using an optical thermal carbon analyzer (DRI model 4000X). Water soluble ionic species, such as NO_3, SO_4, NH_4, Na, and Cl will be extracted from the quartz and nylon filters and analyzed by ion chromatography. Two gaseous species, nitric acid and ammonia, will be determined by the denuder difference method and PM concentrations will be measured by filters on a filter pack.

A total of 16 filters will be analyzed for each 24-hr sample from each sampler at each site and each collocated sampler: 7 quartz filters will be extracted for ion analysis (NH_4, NO_3, SO_4, Cl, Na); 3 quartz filers will be analyzed for carbon analysis; 4 nylon filters will be used for nitrate analysis; and 2 Teflon filters will be used for mass measurements and elemental analysis. Field blanks will be collected from all sampling sites for each month and will be chemically analyzed. The analyzed results will be used to determine the background levels of chemical components deposited on the filters and sample concentrations will be adjusted accordingly.

PM Data Use

As noted previously, the TEP 2000 ambient monitoring program will provide a much more complete database for the chemical speciation required under the new EPA PM_{10}/$PM_{2.5}$ standards, and a more complete database for receptor and dispersion modeling. The October and November time frame is the seasonally favorable time for high ambient particulate concentrations. If conducted, daily sampling during October and November will provide a continuum of daily speciated data across the Basin to help validate episodic PM models such as UAM-AERO, and will provide a more detailed database for characterizing high PM conditions.

The TEP 2000 PM data will be essential to the modeling analysis and development of the 2000 AQMP. The data will be used to estimate the source contributions using the Chemical Mass Balance (CMB) receptor model, and will also be used for the performance evaluation of the annual PM model UAM/LC and the episodic model of UAM-AERO. The data will also provide invaluable information on the chemical composition, spatial and temporal variations of PM10 and $PM_{2.5}$ in the Basin. The TEP 2000 data can also be used by academia, health-related research groups, and environmental groups as well as the U.S. EPA for evaluation of the new $PM_{2.5}$ standard.

Post TEP 2000 Enhanced Ambient Air Monitoring Program

The TEP 2000 ambient monitoring program will be concluded at the end of July, 1999. However, PM sampling will still be continued at four locations (Anaheim, Downtown Los Angeles, Fontana and Rubidoux) once every three days on an ongoing basis with one site having a collocated sampler. All four sites will have $PM_{2.5}$ FRMs as part of the core network. It is anticipated that the network will be expanded every third year to meet AQMP needs, and in the intervening two years, these four sites will provide value for continuity and trend purposes.

4.3 Continuous $PM_{2.5}$ Monitoring

Continuous BAM samplers fitted with a $PM_{2.5}$ cut point inlet are planned for use to supplement FRM monitors at several sites. BAM monitors are selected because experience in the Basin indicate that the BAM is less susceptible to data errors caused by volatilization of organic and nitrate fractions than the micro balances technique. Proposed $PM_{2.5}$ BAM sites are listed in Table 4.4.1, below.

Table 4.3.1 Continuous $PM_{2.5}$ Monitors to be Deployed in 1999

Site Location	Airs Site ID	Operating Agency	Monitoring Objective	Monitoring Method
Banning	060650012	SC	T	$PM_{2.5}$ BAM
Indio	060652002	SC	T	$PM_{2.5}$ BAM
Santa Clarita	060376002	SC	T	$PM_{2.5}$ BAM

(Legend: See Table 3.2.1)

5.0 SAMPLING FREQUENCY

The federal requirements specify everyday sampling for $PM_{2.5}$ at certain core SLAMS locations and one in three day sampling at all other $PM_{2.5}$ sites. In the South Coast Air Basin and Coachella Valley Air Basin there are a total of seventeen sites to be implemented in 1998. Out of these seventeen, seven sample on a everyday schedule, the remainder on a one in three day basis. There are two additional sites in 1999 that will operate on a one in three day schedule and four speciation samplers that will run on a one in twelve day basis.

PM_{10} sites are required to sample on a one in three day basis but SCAQMD has determined moving to a one in three day schedule from the current one in six would not be of significant benefit to the database considering the current concentrations of PM_{10} and limitation of monitoring resources. We propose the current schedule of one in six for all sites with the exception of Rubidoux and Indio which would adhere to the one in three day requirement until a waiver is approved. Please refer to Attachment 1 of the February 20, 1998, letter from the ARB for further information regarding EPA sampling frequency requirements.

5.1 $PM_{2.5}$ FRM Sampling Frequency

The SCAQMD will operate the $PM_{2.5}$ network according to the schedule proposed by EPA, although concerns regarding adequate funding remain. During the start-up of the network in 1998, all sites will operate on a one-day-in-three basis, using the waiver provisions from daily sampling as allowed by USEPA. Beginning on January 1, 1999, the seven core sites proposed for daily sampling will begin operating in that mode. The sites with primary mass samplers selected for implementation beginning in 1998 and 1999 are summarized along with their schedules in Table 5.1.1.

Table 5.1.1 $PM_{2.5}$ Sampling Frequency

Site Location	AIRS Site ID	Required Sampling Frequency	Proposed Time Period	Proposed Frequency
Indio	060652002	1 in 3	1-1-99	1 in 3
Anaheim	060590001	Everyday	1-1-99	Everyday
Azusa	060370002	Everyday	1-1-99	Everyday
Big Bear	New site	1 in 3	1-1-99	1 in 3
Burbank	060371002	1 in 3	1-1-99	1 in 3
Fontana	060712002	Everyday	1-1-99	1 in 3
Lake Forest	060592001	Everyday	1-1-99	1 in 3
Los Angeles	060317103	Everyday	1-1-99	Everyday
Lynwood	060371301	1 in 3	1-1-99	1 in 3
Long Beach	060374002	Everyday	1-1-99	Everyday
Ontario	060716001	1 in 3	1-1-99	1 in 3
Pasadena	060372005	1 in 3	1-1-99	1 in 3
Pico Rivera	060371601	1 in 3	1-1-99	1 in 3
Reseda	060371201	1 in 3	1-1-99	1 in 3
Riverside	060651003	1 in 3	1-1-99	1 in 3
Rubidoux	060658001	Everyday	1-1-99	Everyday
San Bernardino	060719004	1 in 3	1-1-99	1 in 3
Palm Springs	060655001	1 in 3	8-1-99	1 in 3
Lake Elsinore	060659001	1 in 3	8-1-99	1 in 3

5.2 $PM_{2.5}$ Chemical Speciation Sampling Frequency

The federal requirements suggest one in twelve day sampling for speciated $PM_{2.5}$. SCAQMD will sample on a one in twelve day basis following the end of the TEP 2000 sampling program at four locations. These locations will sample on a one-in-three-day basis from August of 1998 to July, 1999. If SCAQMD determines that the sampling frequency is not adequate to support control plan development, the District is prepared to make appropriate adjustments to the sampling frequency.

5.3 PM_{10} Sampling Frequency

The new U.S. EPA federal regulation requires the sampling frequency for PM 10 to increase from the current one in six day to one in three day. The SCAQMD requests the U.S. EPA Region IX grant a statewide waiver allowing sampling to remain at the current one in six day schedule, with the exception of Rubidoux and Indio, because historical data indicate these are the locations most likely to exceed the 24-hour PM_{10} standards. Sites that will not be covered by the requested waiver are listed in Table 5.3.1.

Table 5.3.1 PM_{10} Sites Not Covered by Requested Waiver

Site Location	AIRS Site ID	Required Sampling Frequency	Date to Initiate Increased Frequency	Proposed Frequency
Rubidoux	060658001	1 in 3	2-1-98	1 in 3
Indio	060652002	1 in 3	6-1-98	1 in 3

Appendix A

Site Descriptions

* Note: Only the Azusa site is provided at this time as an example. The completed site descriptions will be provided with the final version of this report.